DOCUMENT RESUME

ED 431 786 TM 029 871

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TITLE The Impact of Students' Background Characteristics on Accommodation Results for Students with Limited English Proficiency.
INSTITUTION National Center for Research on Evaluation, Standards, and Student Testing, Los Angeles, CA.
SPONS AGENCY Office of Educational Research and Improvement (ED), Washington, DC.
PUB DATE 1999-04-00
NOTE 11p.; Paper presented at the Annual Meeting of the American Educational Research Association (Montreal, Quebec, Canada, April 19-23, 1999). For related documents, see TM 029 872 and TM 029 874.
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Definitions; English (Second Language); Glossaries; Grade 8; *Junior High School Students; *Limited English Speaking; Mathematics Tests; Performance Factors; *Student Characteristics; *Test Construction; Test Items; Test Results; *Timed Tests

ABSTRACT

This study examined the impact of students' background characteristics (English language proficiency) on the level of effectiveness of various types of testing accommodations. Data were collected from 946 eighth graders, some of whom were English language learners. Four accommodation strategies were used: (1) modified (simplified) English language for the test items; (2) a glossary of potentially difficult nonmathematics terms; (3) original English with extra time allowed; and (4) the glossary with extra time allowed. Findings suggest that different forms of accommodation produce different results. The form of accommodation with the greatest effect on all students was the provision of an English glossary with definitions of potentially difficult nonmathematics terms plus extra time allowed. The English glossary alone did not help students, and in some cases even had a negative impact on performance, perhaps because students were presented with more information than they could process in the limited amount of time they had. The provision of extra time only resulted in slightly higher scores for most students, but not for all subgroups. The language clarification of test items was the only option that helped limited English proficient students more than others. Findings suggest caution against blanket statements about the general effectiveness or lack of effectiveness of a particular form of accommodation for English language learners. (Contains five tables.) (SLD)

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The Impact of Students' Background Characteristics on Accommodation Results for Students with Limited English Proficiency

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Paper presented at the 1999 Annual Meeting of the American Educational Research Association, Montreal, Canada.

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The Impact of Students' Background Characteristics on Accommodation Results for Students with Limited English Proficiency

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This study examined the possibility of the impact of students' background characteristics (focusing on their language background) on the level of effectiveness of different types of accommodations. The findings of this study suggest that students' background variables may indeed impact their performance under a certain form of accommodation. That is, some students may benefit more from a particular form of accommodation than others.

Data for this study were collected from 946 8th-grade students (ages 13-14). Four accommodation strategies were used: 1) Modified (simplified) English language of the test items; 2) Glossary, where the non-math terms identified as potentially difficult for LEP students to understand were simplified; 3) Original English with extra time -- where students were given extra 25 minutes to work on math test; and 4) Glossary with extra time -- Glossary, plus extra 25 minutes. Another group of students receiving the original English form of the items was added to sever as a control or comparison group. Students were assigned randomly to the different accommodation strategies (and to the comparison group) within participating classrooms, to control for teacher and school effects.

In this study, we investigated the effects of students' background characteristics (particularly the language-related background variables) on their performance by including the interactions between different types of accommodation with students background characteristics. We created two multiple regression models. The total math

test score was the criterion variable in the two models. In the first model which was called the "full model", all the background variables (including the language background variables) and their interactions with the math scores were included as predictors. In the second model which was labeled as the "restricted model" only the variable representing the main effects were included.

Multiple regression analyses (using criterion-scaling methodology) suggested that the interaction effects significantly added to the level of prediction of students' performance. For example, looking at the β coefficients of the multiple regression models to judge the relative importance of the predictors suggest that the interaction effects are powerful predictors, sometimes even more powerful than some of the main effects. These results supported the notion stated earlier that students' background characteristics must be considered when using accommodations for students with limited English proficiency.

Table 1 summarizes the results of our analyses comparing students' performance receiving different forms of accommodations. Findings in Table 1 indicate that:

- Both ELL and non-ELL students showed the greatest increases in performance when provided *both* a glossary and extra time.
- ELL scores were higher on all types of accommodation except Glossary Only. In other words, ELL students were helped by Modified English, Extra Time, and Glossary + Extra Time.
- Students who were better readers, as measured by Reading Test scores, achieved higher math scores.

Table 2 summarizes the results of multiple regression for the full model for the entire sample, and Table 3 presents similar results for the restricted model.

Insert Table 2 about here

As the data in Table 2 indicate, the regression model (full model) with all main effects and interaction variables yielded a multiple R of .530 (R^2 = .281). For the restricted case, the regression model used only the main effects variables (see Table 3) and yielded a multiple R of .500 (R^2=.251). The difference between R^2 of the full model (.281) and that of the restricted model (.251) is not large. However, when the R^2 of the two models were compared statistically, an F-ratio of 4.66 was obtained. This F-ratio is significant beyond the .01 nominal level, which indicates that the full model has more prediction power and explains a larger amount of the variance of the dependent variable than the restricted model.

These findings suggest that interaction effects added to the power of prediction above and beyond the main effects. The more interesting point in the two models is that of the 14 predictors in the full model (Table 2), only three were significant at the .01 nominal level (main effect, interactions between the type of math class and accommodation, and interaction between language of instruction in math class and accommodations). Only one of these three significant predictors is a main effect, and the other two are the interaction terms. Also, the predictors with relatively large βs are mainly the interaction terms.

Insert Table 3 about here

These results suggest that the accommodation strategies can be seen to have greater efficacy when the performance of subgroups of students with different background characteristics is considered.

Table 4 shows the average math performance across the three levels of math classes with different forms of accommodation. As the data in Table 4 indicate, the most effective form of accommodation for all three levels of math classes was the glossary plus extra time. In math classes at each level--8th grade math, pre-algebra, and algebra or integrated math--the students who received the glossary plus extra time performed the highest on average as compared to students who received other forms of accommodation. With the glossary and extra time, average math scores for 8th grade math, pre-algebra, and algebra or integrated math classes were 13.52, 17.44 and 23.13 respectively.

Insert Table 4 about here

As shown by the multiple regression analysis and by the mean table, the least effective form of accommodation varied across three levels of math classes. Table 4 suggests that there is a significant interaction between the effectiveness of accommodations and the level of math classes. For example, students in 8th grade math classes performed lowest on average with the extra time (M=11.69), while students in pre-algebra classes scored lowest on the math items in original English (M=13.55). Students taking advanced level math classes obtained the lowest score on the modified English version of the test (M = 18.36). The results thus indicate that the level of

effectiveness of the accommodations in this study differs according to the level of the math classes that students are in.

The results in Table 4 show that different subgroups benefited differentially from certain accommodations. For example, among students in 8th grade math classes, having a glossary plus extra time resulted in a math score that was 9% higher (13.52-12.37)/12.37=.09) than on the standard test (original English). However, among students in pre-algebra classes, the same accommodation resulted in an average score that was 29% higher (17.44-13.55)/13.55=.29) Thus, this form of accommodation helped pre-algebra students more than it helped students in 8th grade math classes.

The results of the analyses also suggest that the language of instruction in math class had an impact on the effectiveness of certain types of accommodations. Table 5 shows the average math scores by forms of accommodation and language of instruction. As the data in Table 5 indicate, the performance of students under different forms of accommodations receiving instruction in "English Only" was different from those in "Not English Only" math classes. For example, students in the "English Only" group had lowest scores on the Original English booklet (M=15.25), while the "Not English Only" group performed lowest on the Glossary booklet (M=11.16).

Insert Table 5 about here

The "Not English Only" group included students receiving math instruction in Spanish as well as students in Sheltered English classes or bilingual education programs. The math score discrepancies between the two groups further point to the importance of familiarity with academic English for student success in content area assessments.

Discussion

In this study, four different forms of accommodation were used in assessing 8th grade students' mathematics performance. Among the accommodation strategies employed in this study was the language clarification of test items, used as form of accommodation for English language learners for the first time in the literature of accommodation. The findings of this study suggested that different forms of accommodation produced different results. In this study, the form of accommodation with the greatest effect on all students was the provision of an English glossary with definitions or paraphrases of potentially difficult non-mathematical words or phrases plus extra time. It is important to note that the English glossary alone (that is, without extra time) did not help the subjects in this study and in some cases even had a negative impact on student performance. This, we suggest, may be due to information overload. That is, students were presented with more data than they could process in the limited amount of time that they had to answer the test items.

One of the most important findings of this study is that some forms of accommodation may help all students, improving students' performance across all subgroups. This may not be a desirable outcome, since it may impact the validity of the accommodation and may affect the construct under measurement (mathematics understanding in this study).

The provision of Extra Time Only resulted in slightly higher math scores for most students but not for all subgroups; extra time did not produce higher scores for students in lower level math classes (8th grade math, as opposed to pre-algebra and algebra classes).

Among the various forms of accommodation used in this study, the language clarification of test items was the only one that helped LEP students more than non-LEP students. This difference, though small, suggests that we give further attention to the linguistic modification of test items as a form of accommodation which is less expensive and more feasible logistically than other forms of accommodation for English language learners.

Another major point is the finding that students' background characteristics impacted the outcome of the different forms of accommodations. The results of multiple regression analyses suggested that the interaction effects which represent the impact of students' background on the outcome of accommodation significantly increased the power of prediction of students' performance in math. An examination of the β coefficients of the multiple regression models and the relative importance of the variables suggest that the interaction effects are important predictors, sometimes even more important than some of the main effects which represent the outcome of accommodation alone.

The data and analyses presented here suggest that some of the accommodation strategies used in this study proved to be more beneficial for some groups of students than others. The findings of this study suggest caution against blanket statements about the general effectiveness or lack of effectiveness of a particular form of accommodation for English language learners.

Table 1. Mean NAEP Math Achievement Scores for 8th Grade Students (35 points possible)

	LEP Status		
Math Book	LEP	FEP/IFE	COLUMN AVERAGE
Original English	12.07 (SD=5.47; n=144)	17.56 (SD=6.70; n=130)	14.68 (SD=6.67; n=274)
Modified English	12.63 (SD=5.23; n=124)	15.94 (SD=6.67; n=117)	14.23 (SD=6.19; n=241)
Glossary only	11.84 (SD=5.94; n=146)	17.78 (SD=6.84; n=121)	14.53 (SD=7.01; n=267)
Extra Time only	12.93 (SD=5.99; n=30)	18.88 (SD=6.50; n=25)	15.64 (SD=6.86; n=55)
Glossary +Extra Time	13.69 (SD=6.74; n=29)	20.37 (SD=7.17; n=30)	17.08 (SD=7.68; n=59)
ROW AVERAGE	12.30 (SD=5.67; n=473)	17.45 (SD=6.83; n=423)	14.73 (SD=6.75; n=896)

Table 2. Full Model

Variables in the Equation	B	SE B	Beta	T	Sig T
Type of math class (main effect)	-0.021	0.290	-.009	-.073	.942
Form of accommodation (main effect)	-3.157	0.848	-.347	-3.72	.000
Type of math by form of acc (interaction)	0.725	0.283	.345	2.56	.011
Language of instruction by acc (interaction)	1.386	0.521	.386	2.66	.008
Lang other than Eng by type of acc (interaction)	0.394	0.401	.066	0.98	.3251
Television viewing by type of acc (interaction)	0.590	0.274	.107	2.153	.032
Television in Spanish by acc (interaction)	0.643	0.486	.184	1.321	.187
Attitudes toward math by accom (interaction)	0.444	0.322	.102	1.380	.168
Country of origin (main)	0.435	0.186	.083	2.473	.014
Speak language other than English (main)	0.507	0.491	.063	1.034	.302
Television viewing (main)	0.329	0.446	.031	0.738	.461
Television viewing in Spanish (main)	-0.086	0.507	-.022	-.170	.865
Attitudes toward math (main)	0.309	0.360	.057	.858	.391
Language of instruction (main)	-0.973	0.545	-.243	-1.079	.075
(Constant)	-7.500	14.76		-.5 08	.6118

$R = 0.530$, $R^2 = .281$, $F = 19.07$, $P = .000$

Table 3. Restricted Model

Variables in the Equation	B	SE B	Beta	T	Sig T
Type of math class (main effect)	0.711	0.076	.321	9.415	.000
Form of accommodation (main effect)	0.714	0.301	.078	2.372	.018
Country of origin (main effect)	0.466	0.178	.089	2.623	.009
Language other than English (main)	0.930	0.277	.115	3.352	.000
Television viewing (main)	0.933	0.352	.090	2.654	.008
Television viewing in Spanish (main)	0.572	0.134	.149	4.289	.000
Attitudes toward math (main)	0.740	0.181	.136	4.084	.000
Language of instruction (main)	0.441	0.137	.110	3.220	.001
(Constant)	-66.565	8.747		-7.610	.000

$R = .500$, $R^2 = .251$, $F = 28.88$, $P = .000$

Table 4. Impact of Accommodations on Average Math Performance Across Three Levels of Math Classes

	English Standard	Original English	Glossary	Extra Time	Glossary Plus Extra Time
8th Grade Math	12.37	13.09	13.23	11.69	13.52
	(123)	(115)	(116)	(29)	(23)
Pre-Algebra	13.55	13.95	13.81	17.07	17.44
	(73)	(57)	(72)	(14)	(18)
Algebra/ Integrated Math	19.40	18.36	20.03	22.50	23.13
	(73)	(56)	(66)	(14)	(15)

Table 5. Impact of Accommodations on the Average Math Performance on English Only and Spanish Only or English Sheltered Classes.

	Original English	English Modified	Original w/ Glossary	Original w/ Extra Time	Glossary plus Extra Time
English Only	15.25	15.77	15.58	16.30	17.51
	(195)	(221)	(216)	(44)	(47)
Not English Only	11.25	11.97	11.16	13.79	16.31
	(56)	(71)	(66)	(14)	(16)

The students enrolled in classrooms with instruction in Spanish only or other types of bilingual education programs are categorized as 'Not English Only'.